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REMARKS

Applicants have received and reviewed the Advisory Action dated May 15, 2007. By way of response, Applicants have amended claims 20 and 70, added new claim 74, and canceled claim 21 without prejudice. The amendment of claim 20 is supported by the specification as originally filed and at least at paragraphs [0017] and [0044], and further includes the limitation of claim 21, which is canceled. New claim 74 is supported in the specification at least at paragraph [0024]. No new matter is presented. Claims 20, 70, 71, and 74 are pending. Applicants submit that the pending claims are supported by the specification.

For the reasons given below, Applicants submit that the amended and newly presented claims are in condition for allowance and notification to that effect is earnestly solicited.

Claims 20 and 21 were rejected under 35 U.S.C. §103(a) as being unpatentable over Knickerbocker, U.S. Patent No. 6,607,620 ("Knickerbocker") in view of Flaitz et al., U.S. Patent No. 5,130,067 ("Flaitz"), further in view of JP 49-37921 (" '921"). Although this rejection has not been raised for the newly presented claims, it is discussed insofar as it might apply. Applicants respectfully traverse the rejection.

Knickerbocker discloses a method for constraining shrinkage during processing of greensheets prior to sintering, e.g. punching, screening, drying, stacking and laminating of greensheet (column 3 lines 32-42). A frame is bonded to a greensheet prior to processing. The frame must be removed from the greensheet after processing (Summary of the Invention). Further, among the group of suitable materials for the frame are polymers and cellulosics that would not survive sintering temperatures and therefore would not prevent shrinkage of the greensheet during sintering of the ceramic (column 4 lines 10-27). The entire teaching of '620 is directed to process steps prior to sintering.

Flaitz discloses a process for controlling Z-direction camber and X-Y bulge and distortion by applying pressure to the surface of a green ceramic structure during sintering. Flaitz et al. disclose several embodiments of their invention including the use of "contact sheets" that rely on friction to control shrinkage (beginning at column 8 line 65). The contact sheets must not fuse to the ceramic and are removed from the ceramic after sintering.

PAGE 7/10 * RCVD AT 7/3/2007 1:27:01 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-3/3 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-56

The '921 disclosure teaches that vanadium oxide increases the strength of glass.

The result of combining these three references would be a method of preventing shrinkage of a greensheet prior to sintering by applying a frame and removing the frame after processing. During sintering, z-direction pressure would be applied. Vanadium oxide would be added at 0.1 to 6 wt% to increase strength.

The combination does not resemble Applicants' invention. Applicants' invention is an improved method for reducing shrinkage of multilayer ceramics during sintering by sintering a monolithic structure comprising a dielectric body and a constraining layer, wherein the constraining layer comprises vanadium oxide. The vanadium oxide reduces the sintering temperature of the constraining layer, so that lower sintering temperatures can be used and as a result, the temperature does not exceed the sintering temperature of the dielectric layer.

Applicants' unique method imparts several unique advantages. By employing the method of the invention, shrinkage is reduced during sintering, and the necessity of removing the constraining layer at the end of the sintering process is obviated. Eliminating the removal of the constraining layer reduces both effort and cost compared to methods of the prior art. This aspect of the invention has been more clearly set forth in amended claim 20 (e.g., the method results in a low- temperature-cofired ceramic comprising vanadium oxide). A further advantage of the invention is that it enables multiply layered low- temperature-cofired ceramics to be generated in a single step and without shrinkage, because multiple monolithic structures can be stacked having a constraining layer as part of each structure. The methods of the prior art do not enable such a process to be carried out, as a single frame is typically required for each monolithic structure.

The combination of Knickerbocker, Flaitz, and '921 does not result in the method of Applicants' invention. Knickerbocker describes a process that is not even sintering. Knickerbocker further discloses the use of a frame as a constraining layer, which must be removed after the disclosed process for greensheets. Flaitz discloses reduction of shrinkage in sintering by applying z-directional pressure. Application of pressure is not necessary using Applicants' method; as is disclosed in the specification at least at paragraph [0045], a bonding

PAGE 8/10 * RCVD AT 7/3/2007 1:27:01 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-3/3 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-56

glass can be used to maintain contact between the layers. Pressure can also be used [0049] but is neither required nor claimed. And while '921 discloses the use of vanadium oxide in glass, it is not employed to sinter particles but rather as an additive to glass to strengthen the glass.

Applicants respectfully submit that there is no teaching or suggestion in any of the references to provide a method for reducing shrinkage of multilayer ceramics during sintering by sintering a monolithic structure comprising a dielectric body and a constraining layer, wherein the constraining layer comprises vanadium oxide, such that removal of the constraining layer from the low- temperature-cofired ceramic is obviated.

Knickerbocker cannot be said to teach or suggest any aspect of sintering, as the methodology of Knickerbocker does not employ sintering. While the z-directional pressure of Flaitz can be employed to maintain contact between the layers of the monolithic structure during sintering, it is not required; for example, bonding glass can be used instead. The '921 reference teaches the use of vanadium oxide to strengthen glass. It cannot be said that there is any teaching or suggestion that there could be any particular advantage in using vanadium oxide to sinter particles instead.

Prior to Applicants' invention, there would be no reasonable expectation of success in employing the method of Applicants' invention. While vanadium oxide is disclosed in '921 as an additive that strengthens glass, there is no teaching that it could also be used to sinter particles and that, in so doing, it could provide a lower sintering temperature than the sintering temperature of a dielectric layer - and that this difference could be advantageously used to reduce shrinkage during sintering of the dielectric layer. Thus, there could be no reasonable expectation that by employing vanadium oxide to lower the sintering temperature of the constraining layer to a temperature less than the sintering temperature of a dielectric layer, then firing a monolithic structure comprising both a constraining layer and a dielectric layer at a temperature greater than the sintering temperature of the constraining layer and less than the sintering temperature of the dielectric layer, a low- temperature-cofired ceramic would result wherein the constraining layer is not removed from the ceramic after sintering. Even if '921 were taken to stand for the idea of using vanadium oxide in sintering particles, there is certainly no reasonable expectation of success in combining the sintering particles as a layer with a dielectric layer as described in

PAGE 9/10 * RCVD AT 7/3/2007 1:27:01 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-3/3 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-56

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Applicants' method of providing reduced shrinkage to the dielectric layer. There could be no reasonable expectation of success in producing such a constraining layer, wherein the constraining layer is not removed from the ceramic after sintering.

Accordingly, based on the foregoing differences, Applicants respectfully submit that the cited references do not render the presently claimed invention obvious, and withdrawal of this rejection is respectfully requested.

Summary

In view of the above amendments and remarks, Applicants respectfully request a Notice of Allowance. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the below-listed telephone number.

Respectfully submitted,

3 July 2007
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